

## Organic Analysis of Catalytic Fischer-Tropsch Synthesis Products and Ordinary Chondrite Meteorites by Stepwise Pyrolysis-GCMS: Organics in the Early Solar Nebula

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Abiotic generation of complex organic compounds, in the early solar nebula that formed our solar system, is hypothesized by some to occur via Fischer-Tropsch (FT) synthesis. In its simplest form, FT synthesis involves the low temperature (<300°C) catalytic reaction of hydrogen and carbon monoxide gases to form more complex hydrocarbon compounds, primarily n-alkanes, via reactive nano-particulate iron, nickel, or cobalt, for example. Industrially, this type of synthesis has been utilized in the gas-to-liquid process to convert syngas, produced from coal, natural gas, or biomass, into paraffin waxes that can be cracked to produce liquid diesel fuels. In general, the effect of increasing reaction temperature (>300°C) produces FT products that include lesser amounts of n-alkanes and greater alkene, alcohol, and polycyclic aromatic hydrocarbon (PAH) compounds. We have begun to experimentally investigate FT synthesis in the context of abiotic generation of organic compounds in the early solar nebula. It is generally thought that the early solar nebula included abundant hydrogen and carbon monoxide gases and nano-particulate matter such as iron and metal silicates that could have catalyzed the FT reaction. The effect of FT reaction temperature, catalyst type, and experiment duration on the resulting products is being investigated. These solid organic products are analyzed by thermal-stepwise pyrolysis-GCMS and yield the types and distribution of hydrocarbon compounds released as a function of temperature. We show how the FT products vary by reaction temperature, catalyst type, and experimental duration and compare these products to organic compounds found to be indigenous to ordinary chondrite meteorites. We hypothesize that the origin of organics in some chondritic meteorites, that represent an aggregation of materials from the early solar system, may at least in part be from FT synthesis that occurred in the early solar nebula.